CLAIMS

I Claim:

Claim 1 – An asset surveillance system, comprising in combination:

an operating mode partitioned fault classification model of an asset comprised of a plurality of fault classification submodels each having an asset operating mode associated thereto;

a fault indication means for determining one or more fault indications given a set of observed asset signals from the asset;

means for determining at least one operating mode of the asset for the set of observed asset signals;

a first selection means for selecting at least one of the fault classification submodels from the operating mode partitioned fault classification model as a function of at least the one determined operating mode for providing a fault classification of determined fault indications for performing asset surveillance.

Claim 2 – The system of claim 1 wherein said fault indication means further includes an operating mode partitioned parameter estimation model comprised of a plurality of parameter estimation submodels each having an asset operating mode associated thereto and a second selection means for selecting at least one of the parameter estimation submodels from the operating mode partitioned parameter estimation model as a function of at least the one determined operating mode.

Claim 3 – The system of claim 2 wherein said fault indication means further includes means for processing the observed asset signals as a function of at least the one selected parameter estimation submodel for defining parameter estimated data.

Claim 4 – The system of claim 3 wherein said fault indication means includes an operating mode partitioned fault detection model comprised of a plurality of fault detection submodels each having an asset operating mode associated thereto.

Claim 5 – The system of claim 4 wherein said fault indication means further includes a third selection means for selecting at least one of the fault detection submodels from the operating mode partitioned fault detection model as a function of at least the one determined operating mode.

Claim 6 – The system of claim 5 wherein said fault indication means further includes means for processing the parameter estimated data as a function of at least the one selected fault detection submodel for determining the one or more fault indications used for providing the fault classification of determined fault indications by said first selection means selecting at least one of the fault classification submodels from the operating mode partitioned fault classification model as a function of at least the one determined operating mode for providing the fault classification of determined fault indications for performing asset surveillance

Claim 7– The system of claim 1 wherein the fault classification of determined fault indications predicts asset failures.

Claim 8 – The system of claim 7 wherein the fault classification of determined fault indications predicts specific asset failures including one or more sensor failures.

Claim 9 – The system of claim 7 wherein the fault classification of determined fault indications predicts specific asset failures including one or more equipment failures.

Claim 10 – The system of claim 7 wherein the fault classification of determined fault indications predicts specific asset failures including an undesirable process operating condition.

Claim 11 – The system of claim 1 further including means for performing asset control as a function of the fault classification of determined fault indications.

Claim 12 – An asset surveillance method, the steps including:

creating an operating mode partitioned fault classification model comprised of a plurality of fault classification submodels each having an asset operating mode associated thereto

acquiring a set of observed signal data values from an asset;

determining at least one fault indication as a function of the observed signal data values;

determining at least one operating mode of the asset for the set of observed asset signals;

selecting at least one fault classification submodel from the operating mode partitioned fault classification model as a function of at least the one determined operating mode, and

using at least the one fault indication and at least the one selected fault classification submodel for classifying faults for performing asset surveillance.

Claim 13 – The method of claim 12 further including the step of performing asset control as a function of the classified faults.

Claim 14 – The method of claim 12 further including the step of predicting asset failures as a function of the classified faults.

Claim 15 – The method of claim 12 further including the step of predicting asset failures including one or more sensor failures.

Claim 16 – The method of claim 12 further including the step of predicting asset failures including one or more equipment failures.

Claim 17 – The method of claim 12 further including the step of predicting asset failures including an undesirable process operating condition.

Claim 18 – An asset surveillance method, the steps including:

partitioning a decision model into a plurality of partitions, each partition having an operating mode associated thereto:

employing a plurality of different methods from a plurality of parameter estimation methods, a plurality of fault detection methods, and a plurality of fault classification methods for different partitions;

determining at least one operating mode of an asset ;

selecting at least one the plurality of partitions as a function of the determined operating mode for tailoring the plurality of parameter estimation methods, the plurality of fault detection methods, and the plurality of fault classification methods for asset surveillance as a function of the at least one determined operating mode.

Claim 19 – The method of claim 18 further including the step of performing asset control as a function of the classified faults.

Claim 20 – The method of claim 18 further including the step of predicting asset failures as a function of the classified faults.

Claim 21 – The method of claim 18 further including the step of predicting asset failures including one or more sensor failures.

Claim 22 – The method of claim 18 further including the step of predicting asset failures including one or more equipment failures.

Claim 23 – The method of claim 18 further including the step of predicting asset failures including an undesirable process operating condition.

Claim 24 – An asset surveillance method, the steps including:

acquiring a set of observed signal data values from an asset;

producing a calculated set of estimated signal data values correlative to the set of observed signal data values acquired from the asset;

comparing the set of observed signal data values to the calculated set of estimated signal data values;

determining a presence of a disagreement between the set of observed signal data values and the calculated set of estimated signal data values on the basis of the comparison step, and

determining a cause of a determined presence of disagreement between the set of observed signal data values and the calculated set of estimated signal data values for performing asset surveillance.

Claim 25 – The method of claim 24 further including the step of using a Bayesian Belief Network (BBN) fault classification method for determining a cause of a disagreement between

the set of observed signal data values and the calculated set of estimated signal data values on the basis of the comparison step.

Claim 26 – The method of claim 24 further including the step of performing asset control as a function of the classified faults.

Claim 27 – An asset surveillance method, the steps including: a method for determining asset status includes the steps of:

creating a fault detection model comprised of a plurality of fault detection submodels each having an operating mode associated thereto;

creating a fault classification model comprised of a plurality of fault classification submodels each having an operating mode associated thereto;

acquiring a set of observed signal data values from an asset;

determining at least one operating mode of the asset for the set of observed signal data values;

selecting at least one fault detection submodel from the fault detection model as a function of at least the one determined operating mode;

determining at least one fault indication as a function of the observed signal data values;

selecting at least one fault classification submodel from the fault classification model as a function of at least the one determined operating mode, and

using at least the one fault indication and at least the one selected fault classification submodel for classifying faults for performing asset surveillance.

Claim 28 – The method of claim 27 further including the step of creating a parameter estimation model comprised of a plurality of parameter estimation submodels each having an operating mode associated thereto.

Claim 29 – The method of claim 28 further including the step of selecting at least one parameter estimation submodel from the parameter estimation model as a function of at least the one determined operating mode ;

Claim 30 – The method of claim 29 further including the step of calculating a set of estimated signal values from at least one selected parameter estimation submodel;

Claim 31 – The method of claim 30 wherein the step of determining at least one fault indication as a function of the observed signal data values includes the step of determining at least one fault indication as a function of both the estimated signal values and the observed signal data values.

Claim 32 – An asset surveillance system, comprising in combination:

a parameter estimation model comprised of a plurality of parameter estimation submodels each having an operating mode associated thereto;

a fault detection model comprised of a plurality of fault detection submodels each having an operating mode associated thereto;

a fault classification model comprised of a plurality of fault classification submodels each having an operating mode associated thereto;

means for acquiring a set of observed signal data values from an asset;

means for determining at least one operating mode of the asset for the set of observed signal data values;

means for selecting at least one parameter estimation submodel from the parameter estimation model as a function of at least the one determined operating mode;

means for calculating a set of estimated signal values from at least one selected parameter estimation submodel;

means for selecting at least one fault detection submodel from the fault classification model as a function of at least the one determined operating mode;

means for determining at least one fault indication as a function of the estimated signal values and observed signal data values;

means for selecting at least one fault classification submodel from the fault classification model as a function of at least the one determined operating mode , and

means for using at least the one fault indication and at least the one selected fault classification submodel for classifying faults for performing asset surveillance.